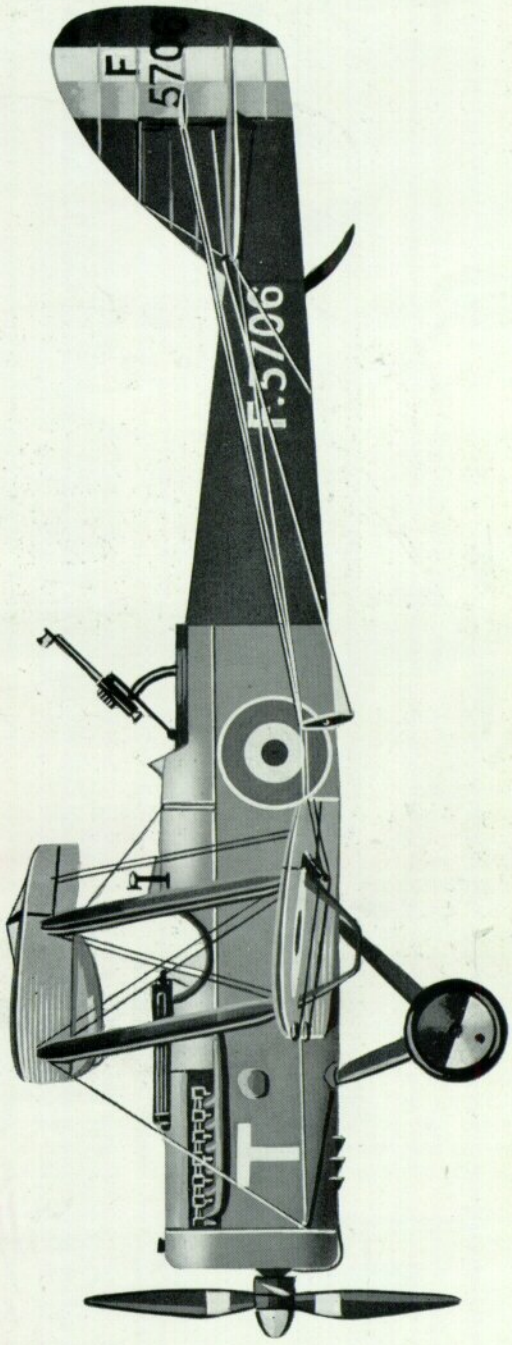
PROFILE
PUBLICATIONS

The de Havilland D.H.4



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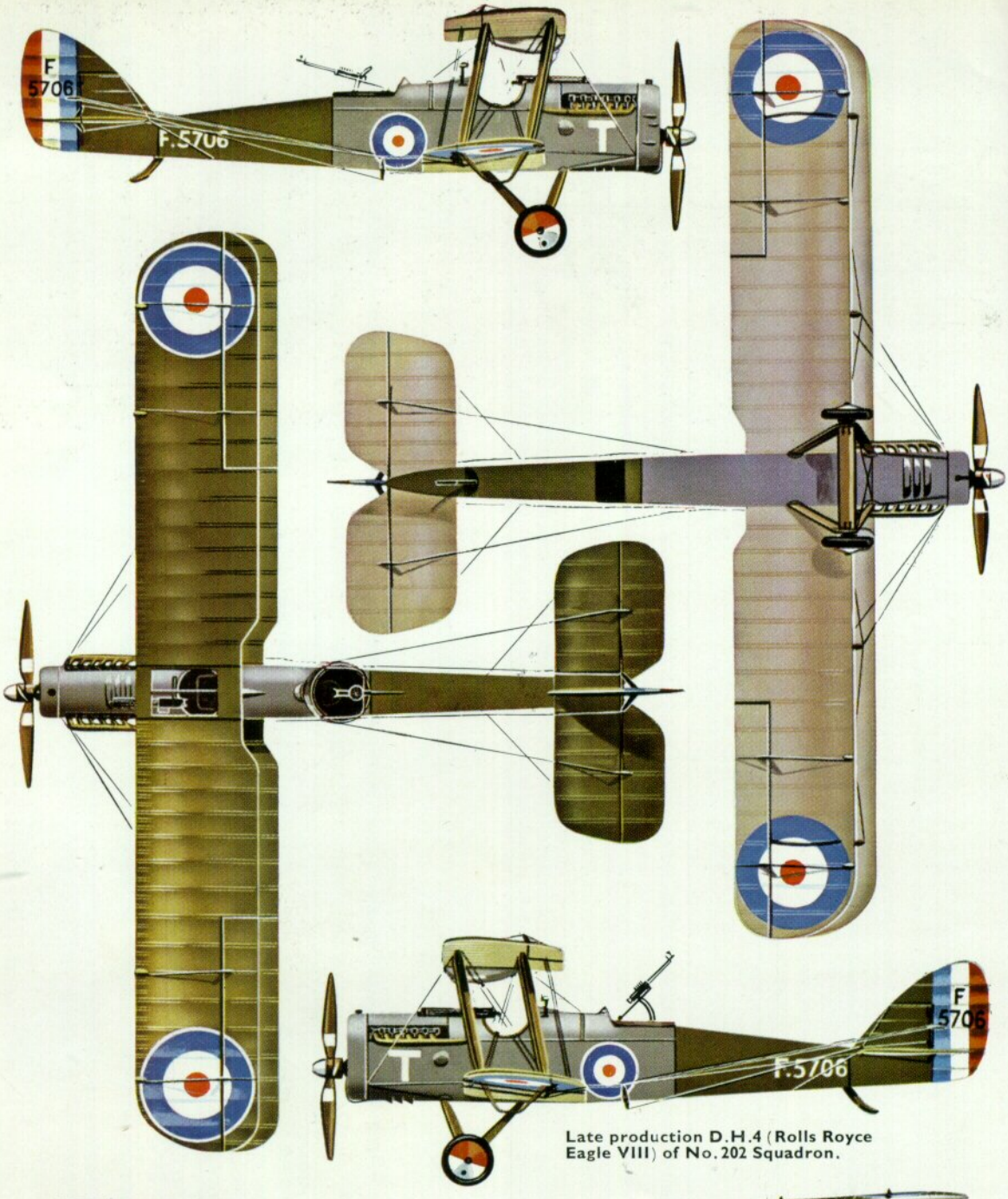
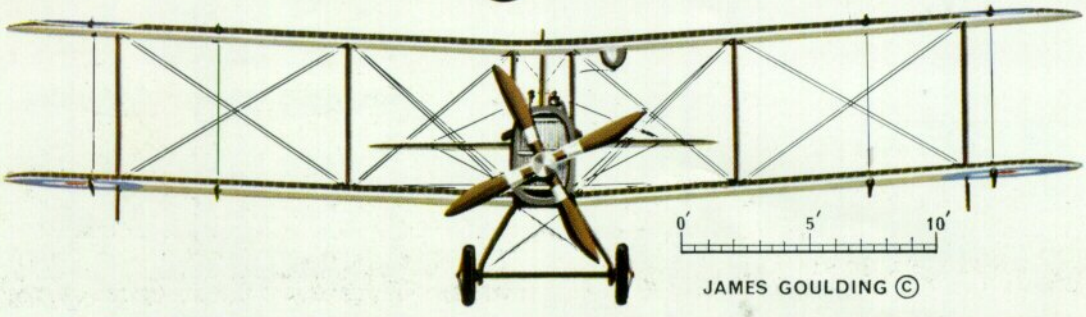


Late production D.H.4 (Rolls Royce Eagle VIII) of No. 202 Squadron.



JAMES GOULDING ©

The de Havilland D.H.4

by J. M. Bruce

N5972 *photographed at Yeovil. It had the twin Vickers guns and raised Scarff ring that characterised D.H.4s of the first Westland batch; no radiator shutters were fitted. A sister aircraft,* N5960, *was tested at Martlesham; the second Vickers gun reduced the speed at 10,000 ft. to 102 m.p.h.; the climb to that height took 18 mins. 18 secs.* (Photo: Harald Penrose, O.B.E., F.R.Ae.S.)

At about the same time as Frank Barnwell was designing the Bristol R.2A as a two-seat reconnaissance aircraft intended to replace the B.E.2c and 2e, Captain (later Sir) Geoffrey de Havilland was working on the design of a generally similar two-seater, to which the Aircraft Manufacturing Co. had allotted the type number D.H.4. The D.H.4 was intended for reconnaissance and bombing duties, and was designed round the 160-h.p. Beardmore engine.

The prototype was nearing completion in the summer of 1916; so too was the first example of a new British aero-engine. This power unit was a water-cooled, six-cylinder in-line engine that had been designed by the young F. B. Halford. He had been greatly impressed by the aluminium monobloc construction of the Hispano-Suiza engine, and in his own first design he employed two aluminium monobloc muffs into each of which three steel liners, threaded over their entire length, were screwed; the cylinder heads were of cast iron, the water jackets of sheet steel.

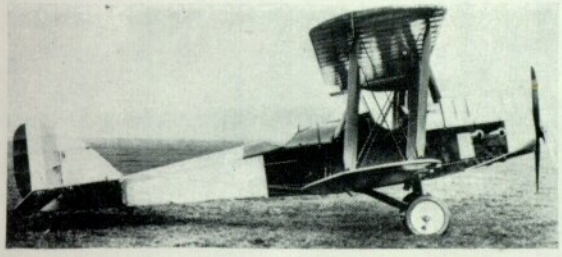
Halford had first become associated with Sir William Beardmore and T. C. Pullinger, head of Arrol-Johnston Ltd. of Dumfries, when he modified the 120-h.p. Beardmore to give 160-h.p. They backed his new engine, which was made at the Arrol-Johnston works and was named the Beardmore-Halford-Pullinger or B.H.P. The first B.H.P. was running on the bench in June 1916; it delivered something over 200-h.p.

Several published references to the combination of this new engine with the first prototype D.H.4 airframe imply that Halford wangled the installation, but it is doubtful whether much wangling would in fact be needed. The B.H.P. was of the same basic configuration as the Beardmore for which the D.H.4 was designed but offered at least 25 per cent more power. Clearly it was sensible to modify the aircraft to accommodate a promising and (for mid-1916) powerful engine.

The overall dimensions of the 160-h.p. Beardmore were: length 1,450 mm., width 506 mm., height 810 mm.; its dry weight was 615 lb. Corresponding values for the 200-h.p. B.H.P. were about 1,708 mm., 476 mm., 1,111 mm., and 690 lb. Because the B.H.P. was so much longer and taller than the Beardmore the nose of the first D.H.4 was somewhat longer than had been intended and the top decking immediately behind the engine cowling had to be given a sharp downward slope to the front of the pilot's cockpit. An oval radiator and four-blade airscrew were fitted; an exhaust manifold on the port side terminated in an upright stack that discharged above the upper wing.

The D.H.4 itself was a sturdy and well-proportioned two-bay biplane made of the conventional materials of its time. The fuselage was remarkable for having cross bracing only in the four bays immediately behind the rear cockpit. The entire forward fuselage and the portion under the tailplane were covered with 3 mm. plywood, producing a strong but light box structure that needed no other bracing. The main fuel tanks were installed immediately behind the pilot's seat, consequently the observer's cockpit was several feet farther aft. The pilot sat immediately under the

Left: *The first prototype D.H.4, with 200-h.p. B.H.P. engine. The centre-section struts converged upwards in side elevation.* (Photo: via K. M. Molson). Right: *The second prototype, with 250-h.p. Rolls-Royce engine.* (Photo: via K. M. Molson)



centre section, which was covered with transparent material to improve his upward view. The main flight surfaces were conventional; the fin and rudder had the characteristic graceful profile that became a distinctive feature of so many de Havilland designs.

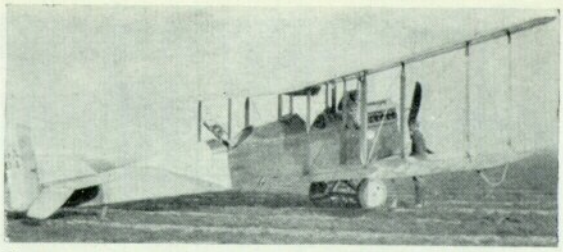
Piloted by its designer, the D.H.4 made its first flight in mid-August 1916. Frank Halford was ill with influenza and was unable to be present, consequently the observer's cockpit was occupied by Major G. P. Bulman. Performance was excellent and the aircraft's handling qualities left nothing to be desired.

This was confirmed by the Testing Flight of the Central Flying School, where the D.H.4 prototype underwent official trials between 21st September and 12th October 1916. Its speed at 10,000 ft. was 113 m.p.h. at 2,946 lb. (without bomb load) and about 108 m.p.h. at 3,148 lb. (with one 262-lb. bomb and fuel for 7·3 hours); that altitude was reached in 16 mins. 20 secs. and 19 mins. respectively, these being the best of several recorded times in the series of tests. The C.F.S. report on the aircraft was enthusiastic:

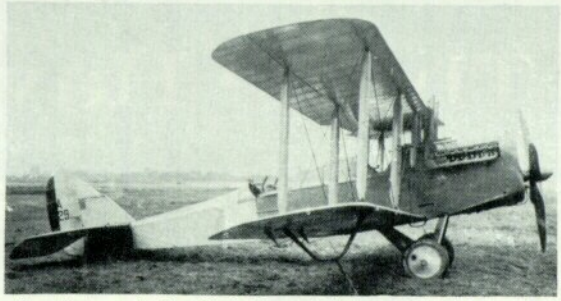
> "Stability: lateral very good; longitudinal very good; directional very good. Length of run to unstick 150 yds.; to pull up (engine stopped) 120 yds. Control: stick; dual for elevator and rudder. Machine is exceptionally comfortable to fly and very easy to land. Exceptionally light on controls. Tail adjusting gear enables pilot to fly or glide at any desired speed without effort. Length of time to prepare engine for starting, 2 mins. approx."

There was no provision at that time for large-scale production of the B.H.P. engine. It seems that further examples were made after its success in the D.H.4, but quantity production was not initiated. The D.H.4 was wanted, however: the first War Office contract, No. 87/A/496, dated 11th July 1916, was initially for fifty aircraft numbered *A2125–A2174*, to be built by the Aircraft Manufacturing Co., Ltd. The date suggests that the D.H.4 was ordered before the B.H.P.-powered prototype flew.

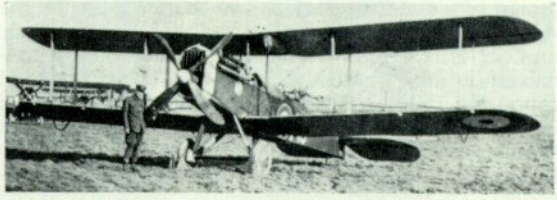
Most of the aircraft of the first Airco production batch were powered by the 250-h.p. Rolls-Royce engine; it is known that *A2129* had the 250-h.p. Rolls-Royce Mk III (later known as the Eagle III) and that the 250-h.p. Rolls-Royce Mk IV (Eagle IV) was installed in *A2166* (engine no. 4/250/138, W.D. 12152), *A2169* (No. 4/250/78, W.D.12160) and *A2170* (No. 4/250/130, W.D.12151). A second prototype D.H.4, fitted with a 250-h.p. Rolls-Royce engine, had been completed later in the summer of 1916. Apart from the inevitable differences in the engine and cowling, the second aircraft had a revised undercarriage with larger wheels, mounted farther forward than that of the first prototype; its centre-section struts were parallel in side elevation; the pilot's cockpit was farther aft; the shape of the observer's cockpit was altered to accommodate a ring mounting for a Lewis gun.



The second prototype at Orfordness with modified rear cockpit and Lewis gun on pillar mounting. The markings in the white stripe on the rudder are GX 04; this may not be the full inscription.

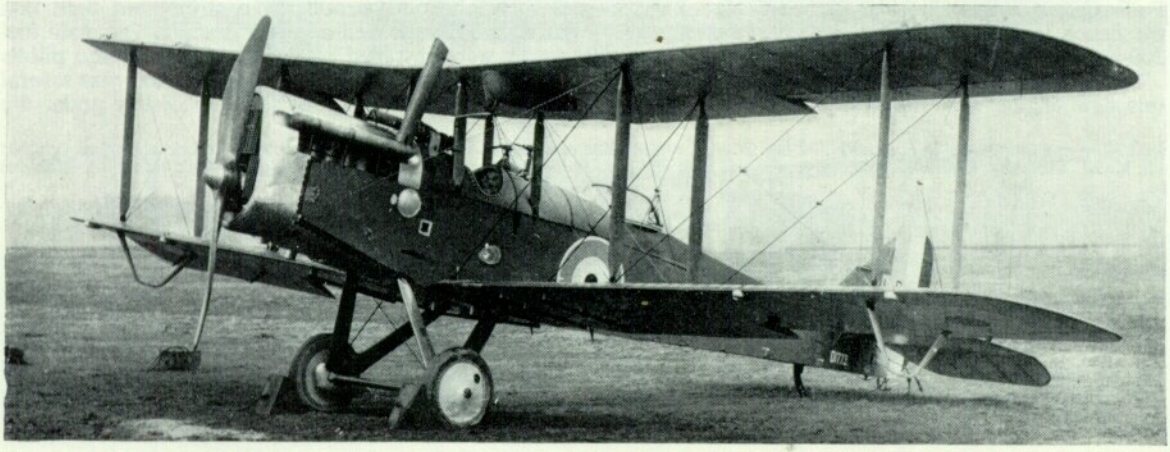


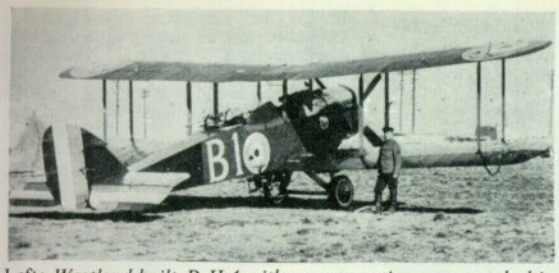
Also photographed at Orfordness, A2129 *was the subject of the Martlesham trial report No. M.83. Its engine was a 250-h.p. Rolls-Royce Mk III (284-h.p. Eagle III), W.D.10071.*



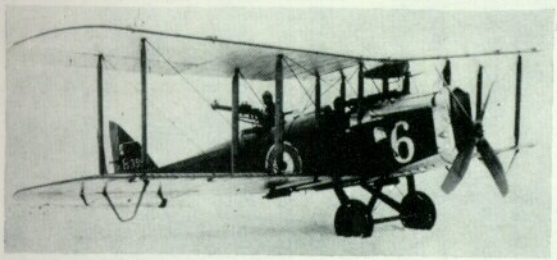
Westland-built D.H.4 with radiator shutters and taller undercarriage, of No. 5 Naval Squadron, Dunkerque.

The D.H.4 Puma installation is here exemplified in D1773, *which also has the two wind-driven fuel pumps that replaced the pressure-feed system of earlier D.H.4s. The taller undercarriage was fitted to all aircraft from* D1769 *onwards in this batch.*
(Photo: Harald Penrose, O.B.E., F.R.Ae.S.)

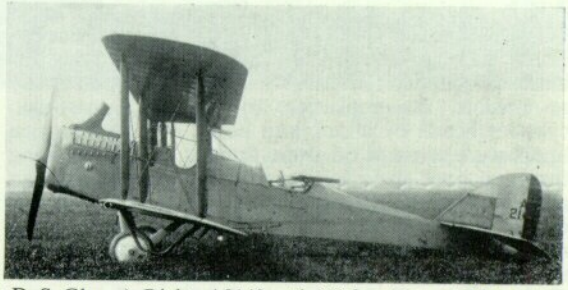




Left: *Westland-built D.H.4 with square-section rear top decking, No. 5 Naval Squadron, Dunkerque.* Right: *The Galloway Adriatic installation did not differ significantly from that of the Puma. The form of the exhaust manifold was not an infallible means of distinguishing one engine from the other.* (Photo: Imp. War Mus.)



Left: B3957 *was one of the N-series Westland-built D.H.4s that were transferred to the R.F.C. It retained the two Vickers guns; in this photograph it is seen with twin Lewis guns on the Scarff mounting and two T.W.R. parachute flares on the under-wing bomb ribs.* Right: *Subject of Martlesham report M.92,* A2168 *had the R.A.F.3a engine. Its Scarff ring had been raised several inches above the upper longerons. This photograph was made at Martlesham Heath in April 1917.* (Photo: via E. F. Cheesman)



Left: *D.H.4 with Fiat A-12 engine, photographed at Wyton.* (Photo: D. S. Glover). Right: A2148 *with 300-h.p. Renault 12Fe engine.* (Photo: Musée de l'Air)

When it first appeared the prototype Rolls-Royce D.H.4 had no armament. It went to the experimental armament station at Orfordness, where it was flown with a Lewis gun on an experimental pillar-type mounting. At this time a coaming was added to the front of the observer's cockpit and the exhaust pipes had been extended by the addition of twin upright stacks.

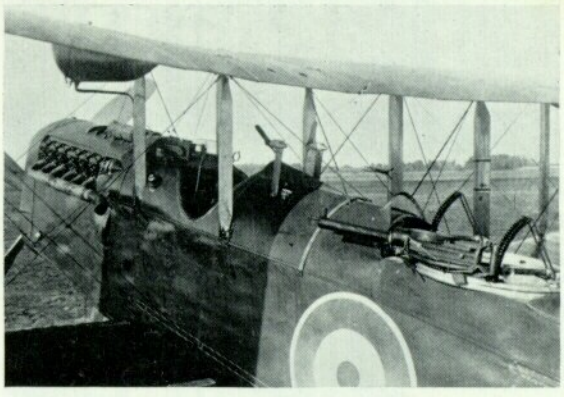
The production D.H.4s began to appear early in 1917. They were substantially similar to the second prototype, but wing-tip skids were added under the lower wings and armament was fitted. A Scarff No. 2 ring mounting for the observer's Lewis gun was mounted directly on the upper longerons; the pilot had a fixed Vickers gun mounted externally on the top decking in front of his cockpit and offset to port. The Vickers gun was synchronised by the new Constantinesco hydraulic mechanism.

Many of the early D.H.4s were delivered to No. 55 Squadron, which was the first R.F.C. unit to be equipped with the type. The squadron flew to France on 6th March 1917, thus earning the minor distinction of being the first operational unit to go there with aircraft fitted with the Constantinesco gear as standard equipment.

The Admiralty also ordered the D.H.4 for the R.N.A.S. Serial numbers (*3696–3697*) were allotted for two Admiralty prototypes but it is doubtful whether the second was built. No. *3696* was still in service early in 1918: it was recorded as being "at Depot" at the R.N.A.S. station, Dunkerque, on 7th February. The first Admiralty production contract, C.P.100786 for fifty aircraft, *N5960–N6009*, was given to the Westland Aircraft Works of Yeovil; the Rolls-Royce engine was specified. Westland-built D.H.4s of this batch had twin Vickers guns for the pilot and, while retaining the rounded after top-decking, had their Scarff ring mountings raised to the level of the top of the fuselage. This improved the observer's handling of his Lewis gun. The first Westland-built D.H.4 was delivered on 29th March 1917.

Unfortunately for the D.H.4, production of its admirable Rolls-Royce engine had run into difficulties. The official history records the unhappy fact that "Of forty-two 250-h.p. Rolls-Royce engines promised for January 1917, only sixteen had been delivered". The activities of the Rolls-Royce company were seriously handicapped by the inability or unwillingness of the Air Board to take decisions relating to the firm's production facilities. Alternative engines had to be found for the D.H.4, for the War Office wanted to equip more squadrons with the type and the original Airco contract had been enlarged by a further 690 aircraft numbered *A7401–A8089* and *B1482*.

In No. 202 Squadron, 'A' Flight was known as the Photographic Flight, 'B' Flight as the W/T Flight, 'C' Flight as the Escort Flight. This Eagle VIII D.H.4 of 'A' Flight had a fairing under the fuselage housing a large camera; several other D.H.4s of this unit had similar fairings. This D.H.4 was the aircraft usually flown by Captain Warne-Brown, D.S.C., and is here seen at Bergues.



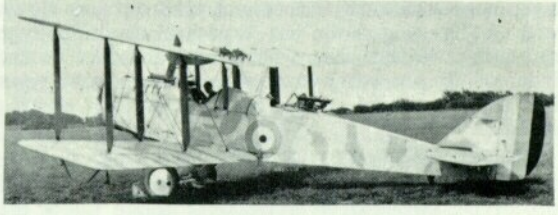
Cockpits of an Eagle VIII D.H.4, at Martlesham Heath.
(Photo: via E. F. Cheesman)

The 200-h.p. B.H.P. engine that had powered the first prototype had, at the request of the Air Board, been studied by the internal combustion engine sub-committee of the Advisory Committee for Aeronautics in January 1917. The sub-committee considered the merits of the B.H.P., the Sunbeam Saracen and Arab, and the Hispano-Suiza with a view to deciding which of the four was most suitable for mass production. The choice fell, unhappily, on the Sunbeam Arab, and the sub-committee also recommended the B.H.P. as superior to the Saracen.

On the strength of this recommendation 2,000 B.H.P. engines were ordered from the Siddeley-Deasy Motor Car Co., Ltd. of Coventry. The Siddeley-Deasy company modified the engine extensively for mass production: J. D. Siddeley was personally responsible for replacing the B.H.P.'s cast-iron cylinder heads by aluminium heads into which open liners were screwed on short threads instead of being threaded over their full length and screwed into an aluminium muff. Aluminium water jackets were introduced in place of the original sheet-steel jackets. The re-designed engine was named the Siddeley Puma; unfortunately, several official documents do not distinguish it clearly from the B.H.P. and it is now virtually impossible to determine which engine was fitted to individual aircraft. It is safe to assume that references to a "200-h.p. B.H.P. Siddeley" engine indicated that a Puma was in fact installed.

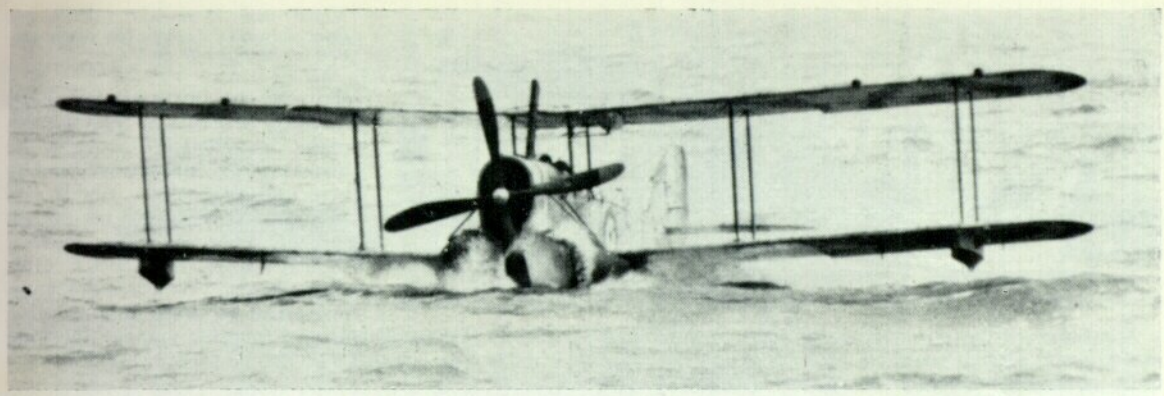
Serious production difficulties beset the Puma and by the time it was in full production, in the spring of 1918, it was obsolete; in service it was not conspicuously reliable. Deliveries of Pumas had begun at the end of June 1917. A batch of the engines were delivered to the Aircraft Manufacturing Co. in July 1917 for installation in D.H.4s, but it was found that the Siddeley modifications has so altered the dimensions of the engine (1,775 mm.× 612 mm.×1,108 mm.) that it would not fit the airframe. The D.H.4s had to be modified to take the Pumas and their delivery was inevitably delayed.

The basic design of the B.H.P. engine was also put into production at the Dumfries works of the Galloway Engineering Co. later in 1917, presumably as a kind of insurance against total failure of the Puma. This version of the engine was named Galloway Adriatic; one was tested at Martlesham in the D.H.4 *A7671* in November 1917. It seems that it was produced in comparatively small numbers only, for on 31st October 1918 the R.A.F. had no more than 89



Above, Right:
A7459, *one of the two long-range D.H.4s (R.A.F. 3a engine) specially modified for the proposed reconnaissance of the Kiel area. After the abandonment of this project the aircraft was intended to be used in the anti-airship rôle, hence the two Lewis guns above the centre section.*

Right:
The other long-range D.H.4, A7457, *still with its fawn and blue camouflage, fitted with hydrovane, flotation gear and wing-tip floats, at the Isle of Grain, 28th January 1918.*



A7457 *shortly after ditching, 29th March 1918.*

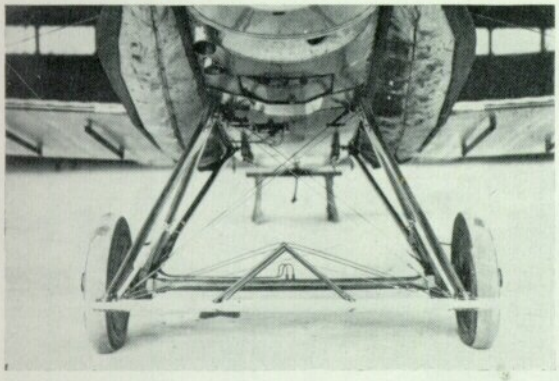
The single-surface hydrovane later fitted to the D1769. *Photograph dated 16th August 1918.*

The Puma D.H.4 D1769 *with biplane hydrovane.* (Below).

Adriatics on charge, all at home stations, whereas 3,255 Pumas were on charge on that date, 546 of them with the Expeditionary Forces and 287 at eastern stations.

In point of time, the first alternative engine to be tried in a D.H.4 was the 200-h.p. R.A.F.3a. This was a water-cooled V-12 that had been designed at the Royal Aircraft Factory in September 1914 as the R.A.F.3 with a bore of 4·3 inches. With a revised lubrication system and bore increased to 4·5 inches it was placed in production at the Acton works of D. Napier & Son. The first tests of the R.A.F.3a in a D.H.4, *A2168*, were made in March 1917. A frontal radiator was fitted and the installation could be distinguished by its single central exhaust stack.

Enough Rolls-Royce engines had been obtained to allow No. 57 Squadron, R.F.C., to be re-equipped with D.H.4s in May 1917; and No. 25 Squadron exchanged its F.E.2ds for the new type, also with Rolls-Royce engines, in the following July. On 26th June 1917 No. 18 Squadron had received the first of the D.H.4s that were to replace its gallant old F.E.2bs, but the D.H.4s that equipped this unit had the 200-h.p. R.A.F.3a engine.



Early operational experience with the R.A.F.3a was not happy. Writing in 1955,* Air Vice Marshal Sir Ranald Reid recorded this of No. 18 Squadron's D.H.4s:

> "At last a replacement type of aircraft arrived. Everyone had been indulging in the new vogue of spinning F.Es for fun (quite a difficult feat), but this did not pay on the new D.H.4s, the first of which promptly lost its tail in the air after a spin; and the R.A.F. IIIA (*sic*) engine was appalling. In the hurry to get this replacement overseas some 57 modifications had not been incorporated and all these bugs came out in service. Poor Brooke-Popham, from R.F.C. H.Q., was often with us trying to help out. He was always met with some new engine horror—valves pounded into balls in the cylinders and shot out of some part of the brute's anatomy. It was a good aircraf otherwise, and later it did great work."

At a surprisingly early stage it was agreed to supply fifty D.H.4s to the Russian Government; it seems possible that the shortage of suitable aero-engines may have had something to do with Britain's willingness to part with the aircraft in September 1917. The Russian D.H.4s were to be powered by the 260-h.p. Fiat A-12, the engines to be provided by the Russian Government. But a British bombing offensive against Germany was hurriedly planned that September in retaliation for German bombing attacks on England, and the D.H.4s would make a useful addition to the British bomber force. Russia was asked to allow these D.H.4s to be diverted to R.F.C. squadrons on the understanding that they would be replaced by seventy-five aircraft in the spring of 1918. With winter close at hand, the Russian Government agreed readily.

**See Flight, 27th January 1956, p. 110.*

A2168 *with 1½-pounder C.O.W. gun firing upwards through the centre section for anti-airship duties.*

A number of these Fiat-powered D.H.4s were used in France, a few of them by No. 49 Squadron. This unit arrived in France on 12th November 1917 equipped with R.A.F.3a D.H.4s, which version remained its standard equipment. Other Fiat-powered D.H.4s saw service in northern Russia in 1918, and some were used at training aerodromes in the United Kingdom. The Fiat installation was generally similar to that of the Puma in the D.H.9, having an underslung radiator. Official tests of a Fiat-powered D.H.4 had been conducted as early as July 1917; the subject aircraft was *A7532*.

During that summer an experimental installation of the 300-h.p. Renault 12Fe was made, in France, in the D.H.4 *A2148*. With this powerful engine performance was good, but no development ensued.

Several other experimental engine installations were made in D.H.4s. A 200-h.p. R.A.F.4d was fitted to *A7864*, which had originally had a 200-h.p. R.A.F.3a; and a 400-h.p. Sunbeam Matabele was installed in *A8083* in 1918. This D.H.4 was one of several that were transferred, engineless, to the R.N.A.S., and that service was responsible for fitting the Matabele.

Some doubt attaches to the connection between the D.H.4 and the 260-h.p. Ricardo-Halford Inverted Supercharger engine. The original B.H.P. Supercharger was running as early as July 1917. It was not supercharged by any form of blower, employing instead a system that introduced a stratum of inert exhaust gas and clean air to the crowns of the working pistons. This weakened the mixture strength at low altitudes, and it was only at heights between 10,000 ft. and 20,000 ft. that a fully effective mixture entered the cylinders.

The engine was unusually tall and threatened seriously to obstruct the pilot's forward view on any tractor aeroplane in which it might be installed. A solution was found by inverting the engine, but it was thought that it would be difficult to win acceptance for such a radical design. The artist F. Gordon Crosby was therefore commissioned to produce a painting of a D.H.4 fitted with the inverted engine. Speaking in 1959, the late J. L. P. Brodie said:

> "The painting sold the design. Three of this engine and three of a 12-cylinder type R.H.A. (Ricardo-Halford-Armstrong) were made, but the end of the war brought about a cessation of their development."*

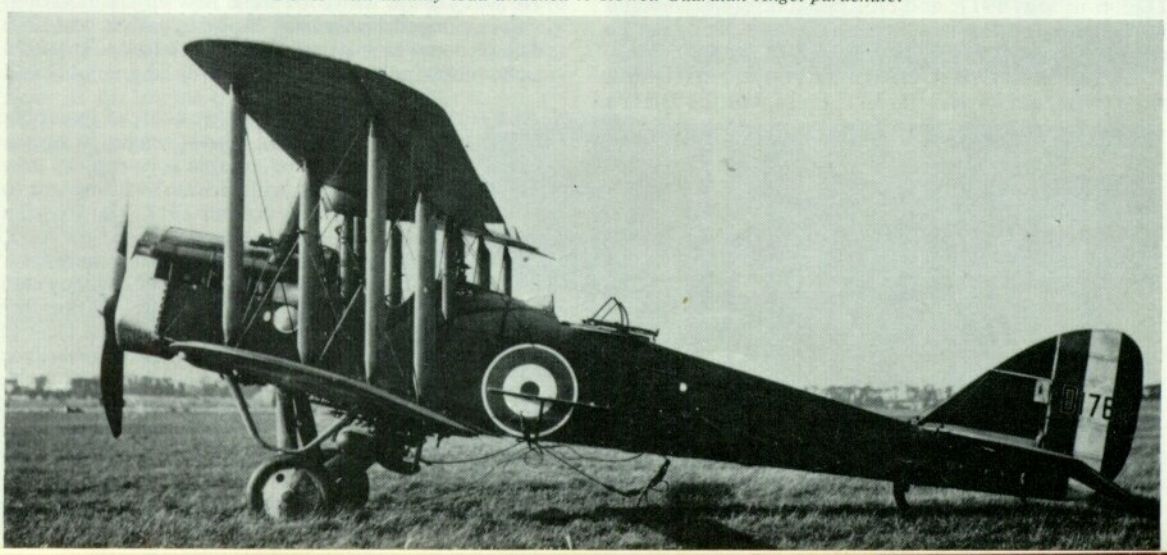
According to another source, however, an installation of a Ricardo-Halford Supercharger engine was made in a D.H.4. This may be a confusion with the Gordon-Crosby painting, or possibly even with the flight trials of the later R.H.A. engine which (contrary to Mr. Brodie's statement) had been installed in the D.H.9 *E630* by 9th January 1919 and was tested at the R.A.E. in the spring and summer of that year.

In July 1919 Martlesham tested a D.H.4 powered by an engine described as the Rolls-Royce Experimental 'G'. This power unit delivered 353-h.p. at 1,800 r.p.m. at sea level, but its precise nature has not yet been discovered.

In August 1917 an early specimen of the superb Rolls-Royce Eagle VIII engine was tested in the D.H.4 *A7446*. This was the finest combination of engine and airframe: without bombs the maximum speed was no less than 133·5 m.p.h. at 10,000 ft., which altitude was reached in nine minutes. The D.H.4 retained its manœuvrability, but the official report notes that it was "tail heavy at full speed and nose heavy with engine off except at extreme tail-plane adjustments". The test subject, *A7446*, was later used by No. 2 Squadron, R.N.A.S., at Bergues; in February 1918 it was on the strength of 'B' Flight of that unit.

The diameter of the airscrew fitted to the Eagle III of *A2129* was 8 ft. 9 in.; that of the double Integral airscrew of *A7446* was 10 ft. 2 in. Ground clearance

D1769 *with dummy load attached to stowed Guardian Angel parachute.*



D.H.4 floatplane at Felixstowe. (Photo: Imp. War Mus.)

had been little enough with the smaller airscrew, consequently a taller undercarriage was designed and was fitted to all the later D.H.4s, regardless of the type of engine fitted. The appearance of the rear fuselage was altered by raising the observer's gun ring, much as on the Westland-built aircraft, and fitting a rectangular rear top-decking.

With the different marks of Rolls-Royce engine the radiators and engine cowling underwent detail changes. No shutters were fitted, originally at least, to the radiators of the 250-h.p. Mk III (Eagle III) engines; the early Westland-built D.H.4s likewise had no shutters. Later, certainly on the Eagles VI, VII and VIII, vertical shutters were fitted.

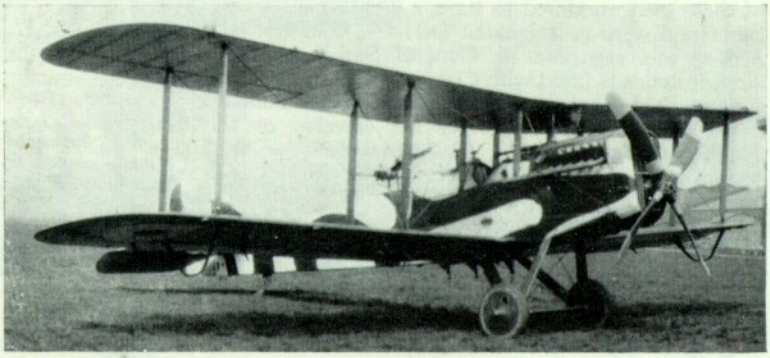
It was as a bomber that the D.H.4 began its operational career, and it is best remembered as the first successful high-performance day bomber. The D.H.4s of No. 55 Squadron were, like No. 48's Bristol F.2As, kept in reserve before the Battle of Arras in order to achieve the maximum surprise. Six D.H.4s of No. 55 Squadron bombed railway sidings at Valenciennes on 6th April 1917 and, says the official history, "a feature of their attack was the ease with which the de Havillands out-manœuvred and out-distanced enemy fighters which endeavoured to intercept them." The D.H.4s' high ceiling enabled them to operate without fighter escort at that time; nevertheless, in the intensive operations connected with Arras No. 55 suffered some losses. In October 1917 this squadron became the first day-bomber unit of the 41st Wing, R.F.C., the precursor of the Independent Force, R.A.F.

The first D.H.4s delivered to the R.N.A.S. went to No. 2 Naval Squadron at St. Pol in the spring of 1917; in July No. 5 Naval Squadron began to replace its Sopwith 1½-Strutters with the D.H.4. At various times aircraft ordered for the R.N.A.S. were transferred to the R.F.C. and vice versa. Seventeen of the first Westland-built R.N.A.S. batch went to the R.F.C. and were apparently renumbered *B3954–B3970*. It seems likely that well over 80 of the aircraft ordered for the R.F.C. were either transferred to the R.N.A.S. or found their way to Naval squadrons.

The R.N.A.S. used its D.H.4s as general-purpose aircraft and they did much valuable photography, reconnaissance and gunnery spotting along the Belgian coast in addition to bombing. On 13th January 1918, No. 17 Naval Squadron was formed at Bergues for anti-submarine patrols; four of its D.H.4s sank the submarine U.B.12 on 12th August 1918. At about that time No. 217 Squadron (as No. 17 Naval had become on 1st April 1918) believed itself to be the only squadron to be entirely equipped with Eagle VIII D.H.4s. Doubtless this was because its work entailed long oversea flights.

An earlier project that would have demanded a long-distance flight over water was an Admiralty requirement for aerial photographs of German naval bases west of the Kiel Canal. Two D.H.4s, *A7457* and *A7459*, were fitted with additional tankage to increase their endurance to 14 hours and special cameras were installed. The crews (originally Sqn. Cdr. the Master of Sempill, Flt. Lt. F. S. Cotton, Lts. G. S. Trewin, D.S.C., and E. B. C. Betts) went to Hendon in June 1917 to train on their aircraft, which were given a special camouflage of matt fawn and sky blue. On 9th August the D.H.4s were flown to Bacton, whence they were to fly across the North Sea, photograph their objectives, and land at Dunkerque.

About mid-August the Admiralty apparently abandoned the Kiel project and decided that the D.H.4s should remain at Great Yarmouth for anti-airship operations in collaboration with flying boats. This decision may have been coloured by the unrelia-



Eagle D.H.4 with experimental camouflage, Isle of Grain, 1918.

bility of the R.A.F.3a engines installed in the two D.H.4s. For its new duties *A7459* was given two fixed Lewis guns above the centre section. It may have been the Yarmouth D.H.4 flown by Flt. Lt. A. H. H. Gilligan and Trewin that, after attacking the Zeppelin L.44 on 5th September 1917, was forced down on the sea by engine failure. Its crew were picked up by the accompanying Curtiss H-12, No. *8666*, which was then unable to take off and drifted for three days.

Greater success attended the Yarmouth D.H.4 *A8032* which, flown by Major E. Cadbury, D.S.C., D.F.C., with Captain R. Leckie, D.S.O., D.S.C., D.F.C., as gunner, shot down the Zeppelin L.70 on 5th August 1918. This was the occasion of the last Zeppelin raid on the United Kingdom, but the evolution of anti-airship weapons went on. Two D.H.4s were experimentally armed with a Coventry Ordnance Works 1½-pounder gun mounted nearly upright between the cockpits, but the Armistice was signed before firing tests could be made. One of the aircraft was *A2168*, earlier the R.A.F.3a engine test subject.

Perhaps the most remarkable wartime development of the D.H.4 was the seaplane version that was tested at Felixstowe. The long floats were built in the experimental shed at Felixstowe and were based on the design of the floats of the German Brandenburg seaplanes. It was apparently hoped that the D.H.4 seaplane would prove to be an effective answer to the Brandenburgs, which were such a thorn in the side of the Felixstowe flying-boat crews. The D.H.4 floatplane was flown successfully but no development was undertaken because the Fairey IIIC was expected to meet operational requirements.

In November 1918 the Puma-powered D.H.4 *D1769*, which had earlier been a test vehicle for the Grain flotation gear, was used in experiments with Guardian Angel parachutes. Two were stowed in containers let into the underside of the fuselage. Preliminary trials with a bomb casing as a dummy load were followed by live drops made by Major Ordlees.

In France, Italy, Russia and in the Aegean the D.H.4 was flown until the end of the war; a few were used in Mesopotamia in 1918. Production had reached its peak early in 1918 but was revived again later that year, doubtless in consequence of the disappointing operational showing of the D.H.9. Late contracts were given to the Glendower Aircraft Co., Ltd., Palladium Autocars, Ltd., and Waring & Gillow, Ltd.

The D.H.4 was built in large numbers in the U.S.A. and was the only American-built British aircraft to see operational use. The American history of the D.H.4 will form the subject of a separate Profile.

After the Armistice the D.H.4 did not survive for long in the R.A.F. A few served with the Communication Wing during the 1919 peace conference; some of these were modified to have a two-seat passenger cabin and were redesignated D.H.4A. One of these, *F2664*, was regarded as General Seely's personal aircraft and was fitted with Conner silencers.

Some D.H.4s were sent to Commonwealth countries under the Imperial Gift Scheme. Twelve of the Glendower batch, *F2672*, *F2673* and *F2705–F2714*, went to Canada, where they entered service with the Canadian Air Force from October 1920 onwards. They were used for forest-fire patrol, photographic survey and mail-carrying duties; the eight survivors were finally written off in November 1928. During their service several had the positions of the pilot's cockpit and the fuel tanks reversed. In Canada the modified aircraft were sometimes called D.H.4B by

One of the so-called Canadian D.H.4Bs with the pilot's cockpit behind the wings, G-CYDM *was used for photographic-survey work and is seen here with a camera port in the fuselage side. Originally* F2706, *this D.H.4 was taken on C.A.F. strength on 19th April 1921 and was not struck off until 30th November 1928.* (Photo: via K. M. Molson)

analogy with the similarly modified American D.H.4B. One of the Canadian D.H.4s, *G-CYCW* (ex-*F2713*) was converted into a single-seater.

Two D.H.4s, *A7929* and *A7993*, went to New Zealand. Both had Eagle VIII engines and both were still in service in March 1927. South Africa also received a few, including *B7991*, in 1921.

Other countries using the D.H.4 included Belgium, Chile, Greece, Iran and Spain. Belgium bought a number of war-surplus aircraft in 1919–20 and fifteen were built by the SABCA in 1926; D.H.4s were used by six units of l'Aeronautique Militaire Belge and remained in service until 1932 Spain operated three squadrons of D.H.4s against the Riffs in Morocco from 1922 onwards.

In the field of post-war commercial aviation the D.H.4 did valuable work, mostly in its D.H.4A form. The year 1919 saw the D.H.4R, a racing single-seat conversion with clipped lower wings, powered by a 450-h.p. Napier Lion and capable of 150 m.p.h.

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SPECIFICATION

Armament: One fixed 0·303 in. Vickers machine gun with Constantinesco C.C. synchronising gear, Aldis and ring-and-bead sights, Cox's 'D'-Type loading handle. One 0·303 in. Lewis machine gun on Scarff No. 2 ring mounting with Norman 100 m.p.h. sight. On *N5960–N6009* twin Vickers guns were fitted. Some R.N.A.S. D.H.4s had pillar mountings for two individual Lewis guns in the rear cockpit instead of the Scarff ring. The bomb load was two 230 lb. or four 112 lb. bombs, or an equivalent weight of smaller bombs, carried in racks under the lower wings and fuselage; depth charges could be carried for anti-submarine work. Negative Lens bomb sight.

Service use—France: R.F.C./R.A.F. Sqns. Nos. 18, 25, 27, 49, 55 and 57; R.N.A.S. Sqns. Nos. 5, 6 and 11 (later Nos. 205, 206 and 211, R.A.F.).

Coastal patrol (based in France): R.N.A.S. Sqns. Nos. 2, 5 and 17 (later Nos. 202, 205 and 217, R.A.F.).

Coastal patrol (U.K.): R.N.A.S. stations Port Victoria and Redcar; R.A.F. Sqns. Nos. 212 (part) and 273 (part).

Home Defence: A few D.H.4s used *ad hoc* from various stations, e.g., Great Yarmouth, Martlesham Heath.

Mesopotamia: Two D.H.4s with No. 30 Sqn., R.F.C., January 1918; 'A' Flight of No. 72 Sqn.

Macedonia: One D.H.4 (from Mudros) attached to No. 17 Sqn., September 1918.

Aegean: 'C' Sqn., Imbros; 'D' Sqn., Stavros; R.N.A.S. Mudros; R.A.F. Sqns. Nos. 220, 221, 222 and 223.

Adriatic: Sqns. Nos. 224, 225, 226 and 227.

Russia: Eight D.H.4s (R.A.F.3a) with R.A.F. Contingent Archangel, May 1918; some Fiat-powered D.H.4s later used in northern Russia.

Belgian use: Six escadrilles (Nos. 7/III, 8/III, 9/III, 10/V, 11/V and 12/V).

G-CYDK *was originally* F2711, *one of the twelve D.H.4s presented to Canada. It was taken on strength by the Canadian Air Force on 19th April 1921 and was written off after a crash at Waldemar on 23rd April 1922.* (Photo: via K. M. Molson)

Power: 200-h.p. B.H.P.; 230-h.p. Siddeley Puma; 230-h.p. Galloway Adriatic; 250-h.p. Rolls-Royce Mks III and IV (284-h.p. Eagles III and IV); 275-h.p. Rolls-Royce Mks II and III (322-h.p. Eagle VI and 325-h.p. Eagle VII); 375-h.p. Rolls-Royce Eagle VIII; 353-h.p. Rolls-Royce Experimental 'G'; 200-h.p. R.A.F.3a; 200-h.p. R.A.F.4d; 260-h.p. Fiat A-12; 300-h.p. Renault 12Fe; 400-h.p. Sunbeam Matabele.

Dimensions: Span 42 ft. 4⅝ in.; length (B.H.P. prototype) 31 ft. 1 in., (Puma and Adriatic) 30 ft. 8 in., (Eagle VI and VII) 30 ft. 2 3/16 in.; height (B.H.P. prototype and Eagle III) 10 ft., (Eagle VI and VII) 10 ft. 1¾ in., (Eagle VIII) 11 ft.; chord 5 ft. 6 in.; gap 6 ft.; stagger 12 in. Dihedral 3 deg.; incidence 3 deg. Span of tail 14 ft. Wheel track 6 ft.; tyres 750 × 125 mm. Airscrew diameter (B.H.P. prototype) 8 ft. 1 in., (Puma and Eagle III) 8 ft. 9 in., (R.A.F.3a) 10 ft., (Fiat) 8 ft. 11 in., (Eagle VIII) 10 ft. 2 in.

Areas: Wings 434 sq. ft.; ailerons each 20·5 sq. ft., total 82 sq. ft.; tailplane 38 sq. ft.; elevators 24 sq. ft.; fin 5·4 sq. ft.; rudder 13·7 sq. ft.

Production: According to official statistics, 1,449 British-built D.H.4s were produced, 848 in 1917, 601 in 1918; these totals apparently excluded prototypes. Serial numbers were allocated as follows:

Aircraft Manufacturing Co. Ltd., Hendon, London N.W.: 3696–3697; A2125–A2174; A7401–A8089 and *B1482; C4501–C4540; D8351–D8430; D9231–D9280.*

F. W. Berwick & Co. Ltd., Park Royal, London N.W.10: B2051–B2150.

Glendower Aircraft Co. Ltd., Sussex Place, South Kensington, London S.W.3: F2633–F2732; H5290.

Palladium Autocars Ltd., Felsham Road, Putney, London S.W.15: F5699–F5798.

Vulcan Motor & Engineering Co. (1906) Ltd., Crossens, Southport: B5451–B5550.

Waring & Gillow Ltd., Cambridge Road, Hammersmith, London: H5894–H5943.

Westland Aircraft Works, Yeovil, Somerset: B3954–B3970 (probably renumbered from N-series D.H.4s transferred to R.F.C.); *B9476–B9500; D1751–D1775; N5960–N6009; N6380–N6429.*

Known A.R.D. rebuilds: B774, B7747, B7812, B7910, B7933, B7941, B7950, B7969, B7987, B7991, B9458, F5828, F5833, F5837, F6001, F6114, F6222, H7118, H7123, H7147.

It is also known that *E4626, F1551* and *F1552* were D.H.4s.

Production in Belgium: Société Anonyme Belge de Constructions Aeronautiques, 13 rue de Bréderode, Brussels: Fifteen D.H.4s for l'Aeronautique Militaire Belge.

WEIGHTS AND PERFORMANCE

Aircraft	Prototype		B9458		D1769 with flotation gear & hydro-vane	D1769 with 2 Guardian Angel parachutes	A7671		A2129	A7446	A2168	A2148	A7532		A8083
Engine	B.H.P.		Siddeley Puma				Galloway Adriatic		Eagle III	Eagle VIII	R.A.F. 3a	Renault 12Fe	Fiat	R-R Exp'tal G	Mata-bele
Bomb load	Nil	One 262 lb.	Nil	Four 112 lb.	Nil	Nil	Nil	Four 112 lb.	Nil	Nil	Nil	Nil	Two 230 lb.	Nil	Nil
Weights (lb.)															
Empty	2,010	2,010	2,197	2,197	—	—	2,209	2,209	2,303	2,387	2,304	—	2,306	2,468	—
Military load	185	436	185	559	—	—	185	559	185	185	166	185	655	185	—
Crew	360	360	360	360	—	—	360	360	360	360	360	360	360	360	—
Fuel & oil	390	340	492	494	—	—	513	513	465	540	510	623	501	513	—
Loaded	2,945	3,146	3,234	3,610	3,495	3,430	3,267	3,641	3,313	3,472	3,340	—	3,822	3,526	—
Max. speed (m.p.h.)															
At 6,500 ft.	117	112	—	—	96	—	—	—	117	136·5	120	120·5	110	—	—
At 10,000 ft.	113	109	114	106	88	101·5	110	104·5	113	133·5	117·5	116	106·5	118	122
At 15,000 ft.	105	103	106·5	—	—	94	100·5	—	102·5	126	110·5	103	—	110	110·5
Climb to:	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.	m. s.
6,500 ft.	9 30	11 00	11 00	15 30	10 30	6 00	9 30	13 10	8 55	5 9	8 00	7 40	14 00	7 30	—
10,000 ft.	16 20	19 00	18 55	24 36	19 10	21 40	16 55	24 55	16 25	9 00	14 15	13 5	26 40	12 55	8 35
15,000 ft.	29 00	—	37 55	—	44 20	48 50	34 55	—	36 40	16 30	29 20	25 45	—	23 35	16 00
Service ceiling (ft.)	—	—	17,500	13,500	15,000	15,000	17,000	13,500	16,000	22,000	17,500	—	14,000	18,000	21,000
Endurance (hours)	4½	4½	4½	—	—	—	—	—	3½	3¾	4	—	4½	—	—

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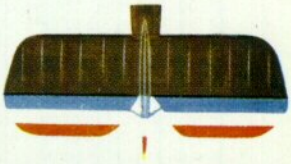
D.H.4, *N5997*, No.202 Squadron.

Fin marking of *N5997*.

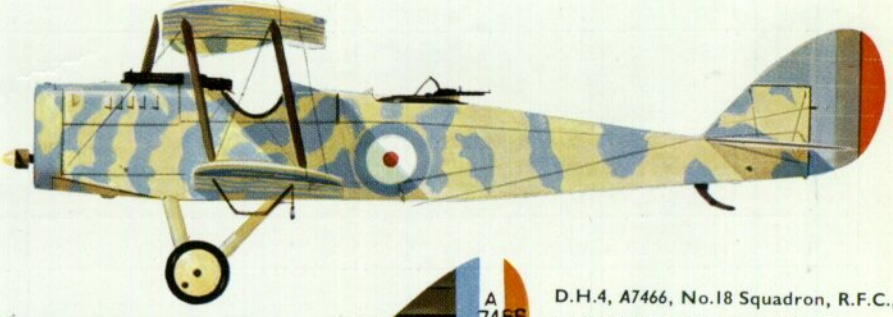
D.H.4, *N5978*, No.5 Wing, Royal Naval Air Service, Dunkirk, France, 1917.

D.H.4, No.5 Wing, Royal Naval Air Service, Dunkirk, France, 1917. Serial unknown.

D.H.4, *A7694*, No.49 Squadron, R.F.C., La Belle Vue airfield, Doullens, France, 1918.

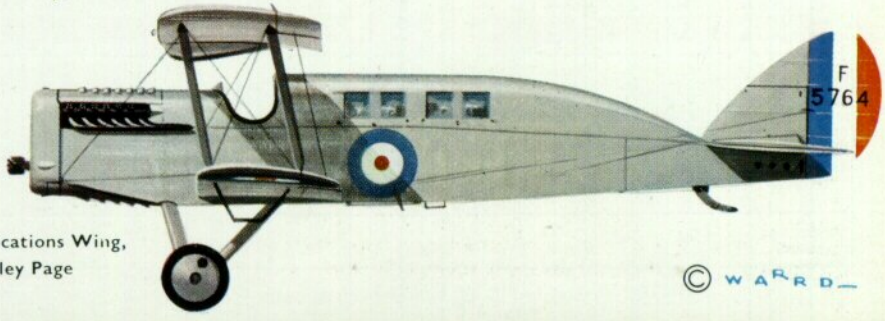


Tailplane marking of some a/c of No.5 Wing, R.N.A.S.



D.H.4, *A7459*, specially modified and camouflaged for projected photo-recce of Kiel Canal, summer 1917. Serial number overpainted.

D.H.4, *A7466*, No.18 Squadron, R.F.C., La Belle Vue airfield, Doullens, France, 1917.



D.H.4, *F5764*, used by R.A.F. Communications Wing, 1919. Later became G-EAWH of Handley Page Air Transport.

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